



Pristimantis tinguichaca Brito, Ojala-Barbour, Batallas & Almendariz, 2016 (Anura, Strabomantidae): range extension and notes on variation in color pattern

Daniela Franco-Mena^{1,2}, Juan Pablo Reyes-Puig^{1,3}, Mario H. Yáñez-Muñoz¹

1 Instituto Nacional de Biodiversidad (INABIO), Rumipamba 341 y Av. de los Shyris, Casilla 17-07-8976, Quito, Ecuador. **2** Ingeniería en Biodiversidad y Recursos Genéticos, Facultad de Ciencias de Medio Ambiente, Universidad Tecnológica Indoamérica, Machala y Sabanilla, Quito, Ecuador EC170301. **3** Fundación Ecominga-Red de protección de Bosques Amenazados/Fundación Oscar Efrén Reyes, calle 12 de Noviembre N° 270 y Luis A. Martínez, Baños, Ecuador.

Corresponding author: Daniela Franco-Mena, danielafranco@indoamerica.edu.ec

Abstract

In this paper we extend the known distribution of the endemic and recently described *Pristimantis tinguichaca* Brito et al., 2016, a terrestrial robber frog characterized by its beige and brown to dark-brown dorsal coloration, flanks with longitudinal or diagonal cream-coloured bands which are separated by brown, and reddish iris. The new records, based on two specimens collected from the Cerro Candelaria and Cerro Mayordomo reserves of Fundación Ecominga in the upper Pastaza River watershed, Tungurahua province, east-central Ecuador, represent the northern limit of the species and extend this species to the Llanganates–Sangay ecological corridor.

Keywords

Eastern Andes, endemic species, Llanganates–Sangay ecological corridor, terrarana, upper Pastaza watershed.

Academic editor: Thiago Ribeiro de Carvalho | Received 19 May 2019 | Accepted 16 September 2019 | Published 27 September 2019

Citation: Franco-Mena D, Reyes-Puig JP, Yáñez-Muñoz MH (2019) *Pristimantis tinguichaca* Brito, Ojala-Barbour, Batallas & Almendariz, 2016 (Anura, Strabomantidae): range extension and notes on variation in color pattern. Check List 15 (5): 857–862. <https://doi.org/10.15560/15.5.857>

Introduction

Frogs of the genus *Pristimantis* Jiménez de la Espada, 1870 reach their greatest species richness in the cloud forests of the tropical Andes of Colombia, Ecuador and Peru (Lynch and Duellman 1997; Hedges et al. 2008; Duellman and Lehr 2009; Pinto-Sánchez et al. 2012; Meza-Joya and Torres 2016). In Ecuador, members of this genus represent up to 70% of the species that form the amphibian fauna in the eastern foothills of the Andes (Reyes-Puig et al. 2014). Inventories in unexplored areas across the upper Pastaza River watershed on eastern Andes of Ecuador have increased substantially in the last

10 years, triggering the description of many new species (Reyes-Puig et al. 2010, 2013, 2019; Yáñez-Muñoz et al. 2010; Reyes-Puig and Yáñez-Muñoz 2012; Reyes-Puig, 2014).

We recently surveyed the anurans from several of the isolated mountains in the upper Pastaza River watershed. During these surveys, we recorded *Pristimantis tinguichaca* Brito, Ojala-Barbour, Batallas & Almendariz, 2016, a species previously known only from Sangay National Park between 2750 and 2830 m (Brito et al. 2017). The new localities extends the lower altitudinal limit of this species to 2472 m, previously thought to be 2750 m.

Methods

For taxonomic determination of the new records and measurements of the morphological variation of the species, we examined comparative specimens in the collection of División de Herpetología of Instituto Nacional de Biodiversidad (INABIO - DHMECN). Description, measurements and terminology follow the standardized format of Lynch and Duellman (1997). The diagnostic characters follow the definitions of Duellman and Lehr (2009). The collected specimens were euthanized with lidocaine, fixed in 10% formalin and preserved in 70% ethanol. The sex and age of the specimens were determined by secondary sexual characteristics (nuptial pads, vocal slits, and size) and direct inspection of the gonads through a dorsolateral incision. The following measurements were taken with calipers to nearest 0.1 mm by DFM at least three times and were averaged: snout–vent length (SVL), tibia length (TL), and foot length (FL).

Life color patterns of the specimens were assessed from field notes and photographs taken *in situ*. Geographic coordinates and elevation were recorded with a GPS unit (WGS84 datum). The examined specimens were deposited in the Instituto Nacional de Biodiversidad (INABIO - DHMECN), in Quito, Ecuador. In addition, we used GeoCat (Bachman et al. 2011) and applied the IUCN Red List Criteria (IUCN 2012) to determine the conservation status of the species.

Results

Pristimantis tinguichaca Brito, Ojala-Barbour, Batallas & Almendariz, 2016

New records. Ecuador, Province of Tungurahua • Machay Ecological Reserve owned by Fundación Ecominga (01°23'15"S, 078°15'56"W), Mario H. Yáñez Muñoz, Juan Pablo Reyes-Puig and Daniela Franco Mena (collectors), 1 March 2018 (1 adult ♀, DHMECN 14426). • Cerro Candelaria Protective Forest, Fundación Ecominga (01°26'24"S, 078°18'15"W), Juan Pablo Reyes-Puig (observer), 8 March 2015 (1 individual photographed; Fig. 1.).

The two specimens were found within montane forest. The adult specimen was collected at night sitting on a palm leaf, inside the forest in shrubby vegetation at 50 cm above the soil. A second individual, a photographic record only, was within a bromeliad at ground level.

Identification. The collected specimen and the photographic record coincided with the species diagnostic characters (Brito et al. 2016), including its beige and brown to dark-brown dorsal coloration, flanks with longitudinal or diagonal cream-colored bands which are separated by brown, and reddish iris. The upper eyelid has a conical tubercle, the heel and tarsus have rounded digital pads, and the webbing on toes is widely expanded and basal (Fig. 2.).

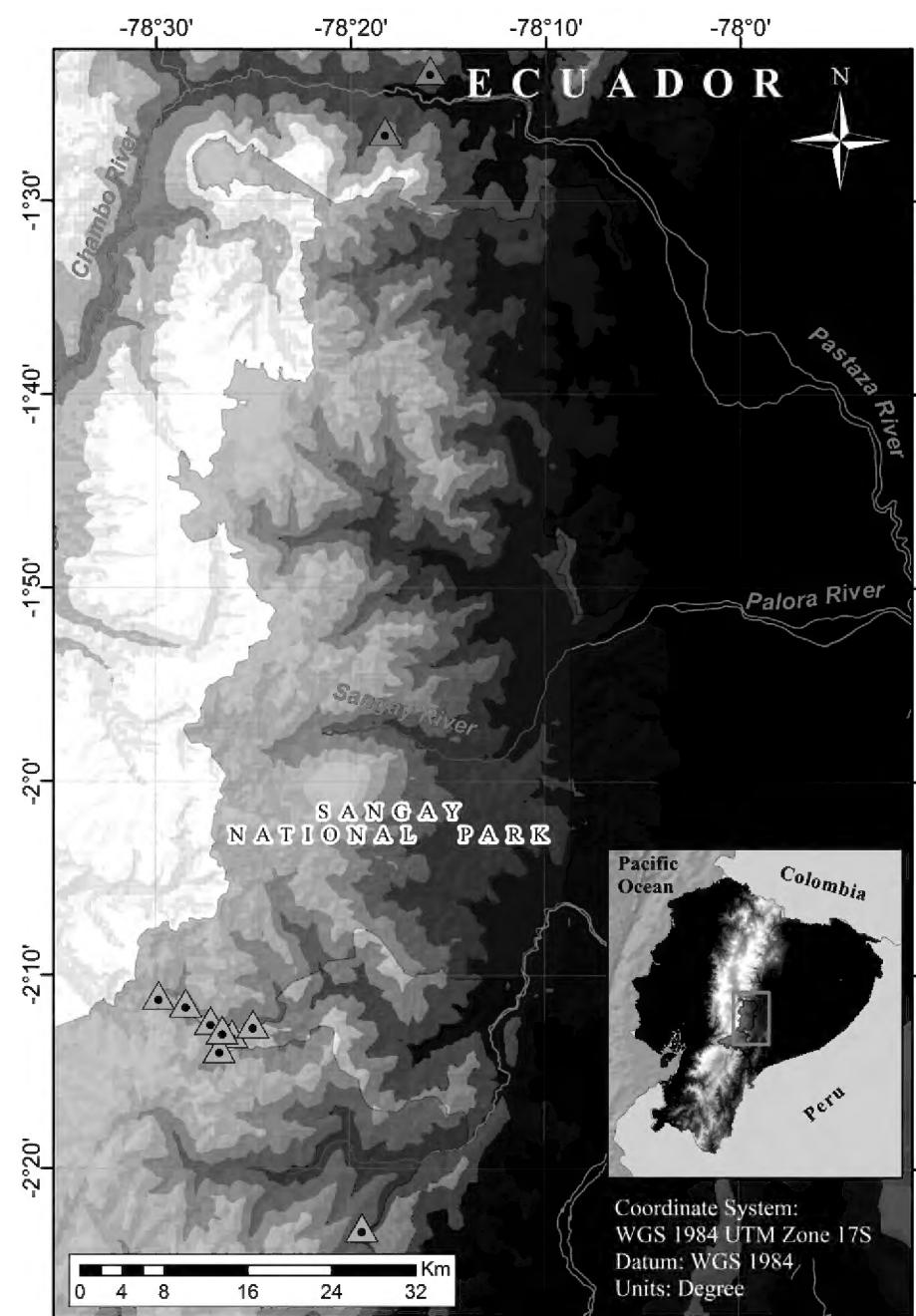


Figure 1. Distribution of *Pristimantis tinguichaca*. Yellow triangles represent the previously known distribution for the species; the red triangles are the new records in the province of Tungurahua.

Discussion

Brito et al. (2017) proposed several endemic species of *Pristimantis* from Sangay National Park. However, the new records reported here show that the distribution of *Pristimantis tinguichaca* extends beyond the northern limits of the Sangay National Park and crosses the canyon of the Pastaza River, thought to be a major barrier. More investigation is required on this species' distribution and biogeographical studies because they may be restricted to an altitudinal band of the montane forest as noted elsewhere in the area such as in Río Zuñag Reserve (Reyes-Puig et al. 2015).

The new records extend the known distribution of *P. tinguichaca* by 82 and 92 km north of the type locality, from Candelaria and Mayordomo, respectively (Brito et al. 2016, 2017; Ron et al. 2019). These records also extend the lower altitudinal limit of this species to 2472 m; it was previously known from 2750 m altitude. These two records are the first reports of *P. tinguichaca* in the province of Tungurahua and are the northernmost locations known for this species.

An additional review of the material deposited in the División de Herpetología of the Instituto Nacional de Biodiversidad (INABIO – DHMECN; Appendix Table A2) allowed us to expand on the reported variation in

color patterns in preserved specimens of this species. The dorsal coloration varies from homogeneous brown to beige (Fig. 3.) with dark-brown, round marks on back

and on the surface between the nostrils.

Pristimantis tinguichaca is reported from nine sites within Morona Santiago Province (Sangay National

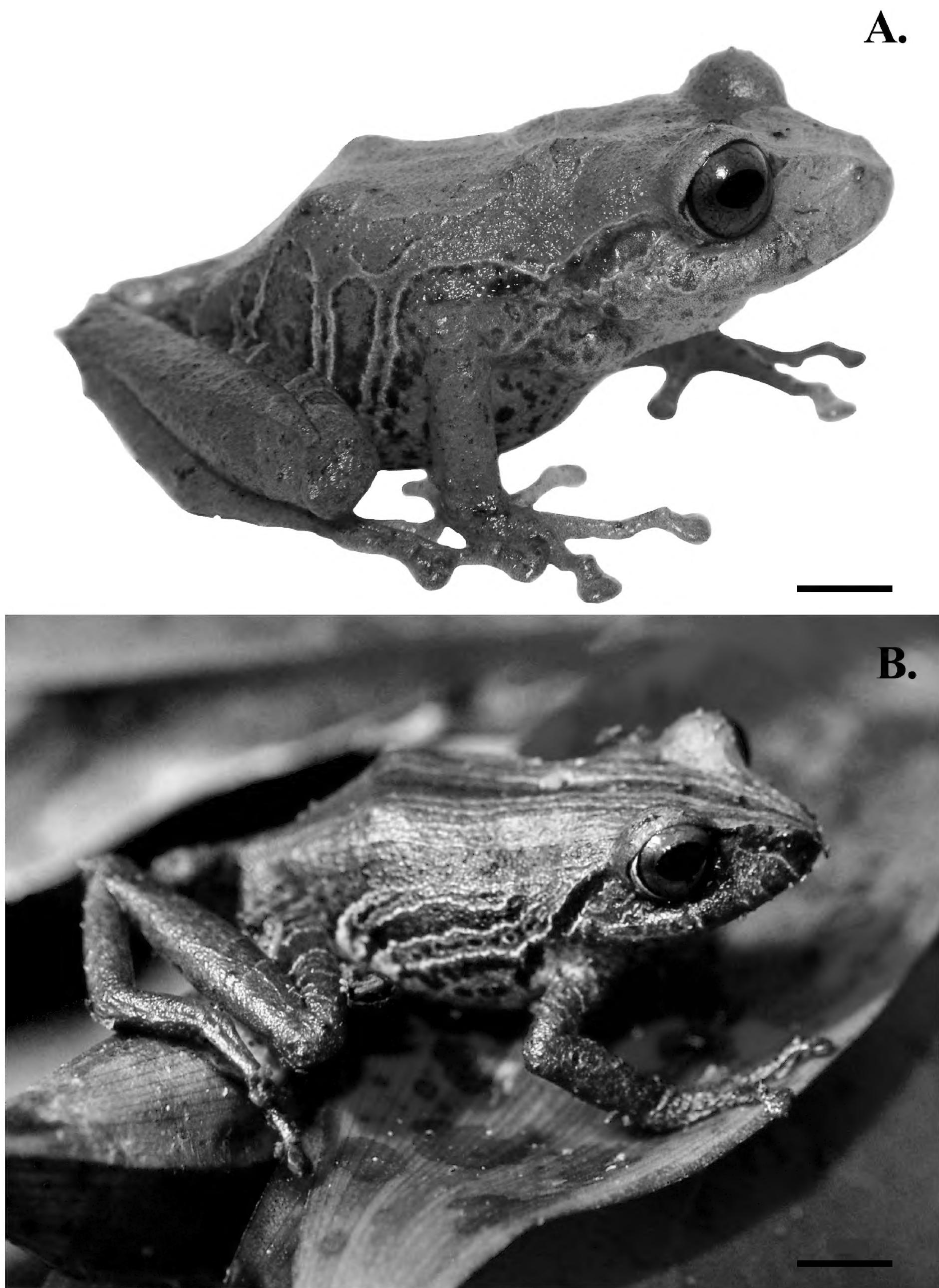


Figure 2. *Pristimantis tinguichaca* from Ecominga reserves in province of Tungurahua. **A.** DHMECN 14426. **B.** photographic record. Scale bars = 10 mm.

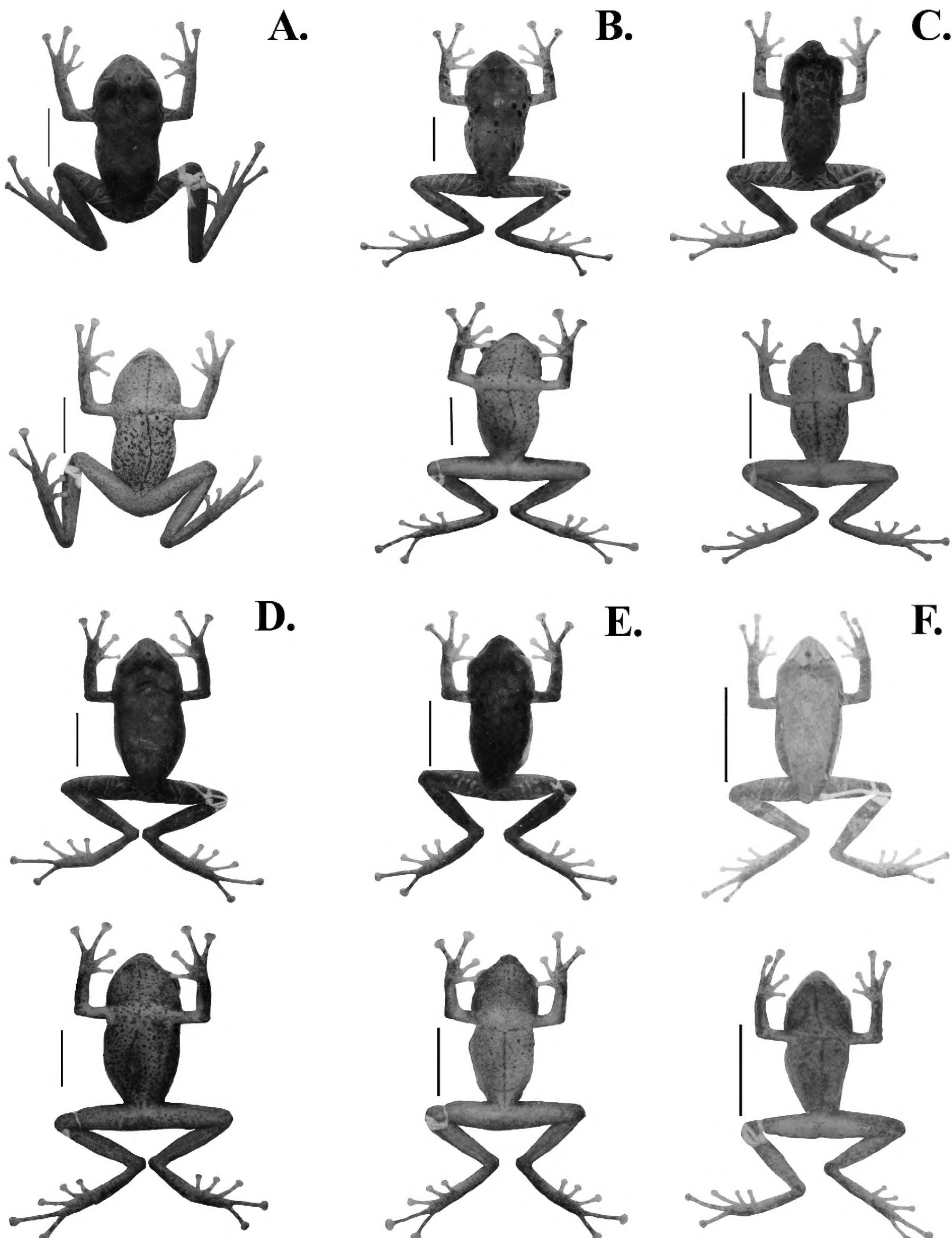


Figure 3. Dorsal and ventral variation in the series of males, females and juveniles of *Pristimantis tinguichaca*. First and second row (from left to right): **A.** DHMECN 14426. **B.** DHMECN 12293. **C.** DHMECN 12296. Third and fourth row (from left to right): **D.** DHMECN 12294. **E.** DHMECN 12295. **F.** DHMECN 12299. Scale bars = 10 mm.

Park); with the addition of new occurrence data reported here from Tungurahua, the extent of occurrence, which was calculated by enclosing all known occurrences within a convex polygon, is 1,373 km². This polygon is mostly located within Sangay National Park and the buffer zone of protected areas, and the new records are from new privately protected areas (Machay Ecological

Reserve and Cerro Candelaria Protective Forest, Fundación Ecominga). We propose the Red List category Data Deficient (IUCN 2012) for this species because extensive adjacent areas in Sangay National Park remain unexplored.

The new records reveal the importance of additional fieldwork to fill information gaps in the diversity

and distributions of anuran communities in the upper Pastaza valley.

Acknowledgements

We thank the EcoMinga Foundation team: Lou Jost, Javier Robayo, Fausto Recalde, Santiago Recalde, Jesús Recalde, and Jordy Salazar; World Land Trust for supporting our land purchases in this area; Adrian Rodríguez for his collaboration in producing the distribution map. The Ministerio del Ambiente issued collection permit no. 02-2018-IC-FAU-DPAT-VS. Field and laboratory work had the support of the Instituto Nacional de Biodiversidad (INABIO) and we give a special thanks to Ballantines for joining us in the herpetological expeditions. Finally, we are grateful to Lou Jost for reviewing the language and grammar throughout the manuscript.

Authors' Contributions

DFM, JRP, and MYM reviewed and prepared the manuscript.

References

Bachman S, Moat J, Hill AW, De Torre J, Scott B (2011) Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. *ZooKeys* 150: 111–126. <https://doi.org/10.3897/zookeys.150.2109>

Brito MJ, Ojala-Barbour R, Batallas RD, Almendáriz CA (2016) A new species of *Pristimantis* (Amphibia: Strabomantidae) from the cloud forest of Sangay National Park, Ecuador. *Journal of Herpetology* 50 (2): 337–344. <https://doi.org/10.1670/13-103>

Brito J, Batallas D, Yáñez-Muñoz MH (2017) Ranas terrestres *Pristimantis* (Anura: Craugastoridae) de los bosques montanos del río Upano, Ecuador: Lista anotada, patrones de diversidad y descripción de cuatro especies nuevas. *Neotropical Biodiversity* 3 (1): 125–156. <https://doi.org/10.1080/23766808.2017.1299529>

Duellman, WE, Lehr E (2009) Terrestrial-breeding frogs (Strabomantidae) in Peru. Natur und Tier Verlag, Münster, Germany, 382 pp.

Hedges SB, Duellman WE, Heinicke MP (2008) New World direct-developing frogs (Anura: Terrarana): molecular phylogeny, classification, biogeography, and conservation. *Zootaxa* 1737 (1): 1–182.

IUCN (2012) IUCN Red List categories and criteria: version 3.1. Second edition. Gland, Switzerland, 32 pp.

Lynch JD, Duellman WE (1997) Frogs of the genus *Eleutherodactylus* in western Ecuador: systematics, ecology, and biogeography.

Special Publication of the Museum of Natural History University of Kansas, Lawrence, USA 23: 1–236.

Meza-Joya FL, Torres M (2016) Spatial diversity patterns of *Pristimantis* frogs in the tropical Andes. *Ecology and Evolution* 6 (7): 1901–1913. <https://doi.org/10.1002/ece3.1968>

Páez-Rosales N (2018) *Pristimantis tinguichaca* En: Ron SR, Merino-Viteri A Ortiz, DA (Eds) *Anfibios del Ecuador*. Versión 2019.0. Museo de Zoología, Pontificia Universidad Católica del Ecuador. <https://bioweb.bio/faunaweb/amphibiaweb/FichaEspecie/Pristimantis%20tinguichaca>. Accessed on: 2019-03-18.

Pinto-Sánchez NR, Ibáñez R, Madriñán S, Sanjur OI, Birmingham E, Crawford AJ (2012) The great American biotic interchange in frogs: multiple and early colonization of Central America by the South American genus *Pristimantis* (Anura: Craugastoridae). *Molecular Phylogenetics and Evolution* 62 (3): 954–972. <https://doi.org/10.1016/j.ympev.2011.11.022>

Reyes-Puig JP, Yáñez-Muñoz MH, Cisneros-Heredia DF & Ramírez-Jaramillo SR (2010) Una nueva especie de Rana *Pristimantis* (Terrarana: Strabomantidae) de los bosques nublados de la cuenca alta del río Pastaza, Ecuador. *ACI Avances en Ciencias e Ingenierías* 2 (3): B78–B82. <https://doi.org/10.18272/aci.v2i3.48>

Reyes-Puig JP, Yáñez-Muñoz MH (2012) Una nueva especie de *Pristimantis* (Anura: Craugastoridae) del corredor ecológico Llanganates–Sangay, Andes de Ecuador. *Papéis Avulsos de Zoología* 52 (6): 81–91. <https://doi.org/10.1590/S0031-10492012000600001>

Reyes-Puig JP, Reyes-Puig CP, Ramírez-Jaramillo SR, Pérez-Lara MB, Yáñez-Muñoz MH (2014) Tres nuevas especies de ranas *Pristimantis* (Anura: Craugastoridae) de la Cuenca Alta del Río Pastaza. *ACI Avances en Ciencias e Ingenierías* 12 (2): B51–B62. <https://doi.org/10.18272/aci.v6i2.179>

Reyes-Puig MM, Reyes-Puig JP & Yáñez-Muñoz MH (2013) Ranas terrestres del género *Pristimantis* (Anura: Craugastoridae) de la Reserva Ecológica Río Zúñag, Tungurahua, Ecuador: Lista anotada y descripción de una especie nueva. *ACI Avances en Ciencias e Ingenierías* 5(2): B5–B13. <https://doi.org/10.18272/aci.v5i2.133>

Reyes-Puig C, Reyes-Puig JP, Velarde-Garcéz DA, Dávalos N, Mancero E, Navarrete MJ, Ron SR (2019) A new species of terrestrial frog *Pristimantis* (Strabomantidae) from the upper basin of the Pastaza River, Ecuador. *ZooKeys* 832: 113–133. <https://doi.org/10.3897/zookeys.832.30874>

Ron SR, Merino-Viteri A, Ortiz DA (2019) *Anfibios del Ecuador*. Versión 2019.0. Museo de Zoología, Pontificia Universidad Católica del Ecuador, Quito. <https://bioweb.bio/faunaweb/amphibiaweb>. Accessed on: 2019-1-3.

Yáñez-Muñoz MH, Cisneros-Heredia DF & Reyes-Puig JP (2010) Una nueva especie de rana terrestre *Pristimantis* (Anura: Terrarana: Strabomantidae) de la cuenca alta del Río Pastaza, Ecuador. *Avances en Ciencias e Ingeniería* 2(3): B28–B32. <https://doi.org/10.18272/aci.v2i3.41>

Appendix

Table A1. Records of *Pristimantis tinguichaca* (Brito et al. 2016) used in Figure 1.

No.	Country	Province	Locality	Latitude	Longitude	Source/Reference
1	Ecuador	Tungurahua	Machay Ecological Reserve	1°23'15"S	078°15'56"W	DHMECN-14426
2	Ecuador	Tungurahua	Cerro Candelaria Protective Forest	1°26'24"S	078°18'15"W	Photographic record
3	Ecuador	Morona Santiago	Tinguichaca	2°13'03.1"S	078°26'03.0"W	DHMECN-12283
4	Ecuador	Morona Santiago	Sambalán	2°12'22.1"S	078°27'09.7"W	DHMECN-12288
5	Ecuador	Morona Santiago	Tinguichaca	2°23'20.19"S	078°18'6.00"W	Brito et al. 2016
6	Ecuador	Morona Santiago	Guabisai, Sangay National Park	2°13'04.7"S	078°82'04.1"W	Brito et al. 2017
7	Ecuador	Morona Santiago	Sangay National Park	2°12'32.72"S	078°24'58.06"W	Ron et al. 2019
8	Ecuador	Morona Santiago	Sangay National Park	2°12'51.29"S	078°26'33.21"W	Ron et al. 2019
9	Ecuador	Morona Santiago	Sangay National Park	2°11'3.40"S	078°29'49.88"W	Ron et al. 2019

Table A2. Specimens of *Pristimantis tinguichaca* (Brito et al. 2016) photographed for Figure 3.

No.	Country	Province	Locality	SVL (mm)	Source
1	Ecuador	Tungurahua	Machay Ecological Reserve	26.92	DHMECN-14426
2	Ecuador	Morona Santiago	Sucua, Sangay National Park	31.11	DHMECN-12293
3	Ecuador	Morona Santiago	Sucua, Sangay National Park	19.82	DHMECN-12296
4	Ecuador	Morona Santiago	Sucua, Sangay National Park	29.47	DHMECN-12294
5	Ecuador	Morona Santiago	Sucua, Sangay National Park	24.09	DHMECN-12295
6	Ecuador	Morona Santiago	Sucua, Sangay National Park	16.30	DHMECN-12299